Highlights
Environmental Management
Technology Innovation & Development

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

WHAT'S INSIDE

June 2010

Latest News

The Office of Technology Innovation and Development (TID) presents this issue of its *Highlights* newsletter bringing you up to date on recent successes and progress. In this issue you will find articles about: 1) a new treatment system for mercury-contaminated water at Oak Ridge National Laboratory, 2) the Office of Waste Processing Integrated Project Team's recommendations for optimizing tank waste treatment, 3) two recent workshops, the Office of Waste Processing International Melter workshop and the Office of Special Nuclear Materials workshop, and 4) the Office of Deactivation & Decommissioning and Facility Engineering (D&D/FE) Program Map.

An upcoming workshop on the Hanford Deep Vadose Zone has been planned by the Office of Groundwater and Soil in collaboration with DOE Richland Operations Office. The workshop, to be held July 20-21, 2010, in Richland, WA, will feature the latest information on deep vadose-zone characterization and remediation methods, scientific studies and treatability testing results, and DOE's Defense-in-Depth approach for the Central Plateau. DOE will use this workshop to benchmark current thinking on deep vadose-zone characterization and remediation to plan for research investment for development of practical alternatives for applicable Records of Decision. For more information, contact:

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Communicating Deactivation and Decommissioning Progress

The Office of Deactivation & Decommissioning and Facility Engineering has developed a comprehensive Program Map tool that provides an overview of DOE's Complex-wide facility D&D program. The D&D Program Map consolidates project data from multiple locations into a single definitive reference that can be found at www.em.doe.gov/EM20Pages/DDMaps.aspx.

While the Office of Environmental Management (EM) continues to make progress in the formidable task of cleaning up the Cold War legacy and the disposition of thousands of excess contaminated facilities, the task of tracking the Complex-wide D&D Program and managing the supporting data has proven to be almost as daunting as the actual field work. To get a complete understanding of the D&D Program, data had to be extracted from multiple information sources, including:

- Integrated Planning, Accountability, and Budgeting System (IPABS)
- Project Baseline Summary (PBS)
- Analytical Building Blocks (ABBs)
- Facility Information Management System (FIMS)
- Baseline documents from the individual sites.

2009, a year of key changes

In 2009, the EM D&D Program changed drastically when three major initiatives expanded the scope of the program, resulting in an increase in the burden of tracking program progress.

The first was an invitation from the Assistant Secretary for Environmental Management to the DOE Offices of Science (SC) and Nuclear Energy (NE), and the National Nuclear Security Administration (NNSA) to propose facilities and legacy waste for transfer to EM for final disposition. After reviewing all facilities proposed for transfer, EM recommended that 63 facilities be accepted into the program.

Paralleling that initiative, the Oak Ridge Reservation's Integrated Facility Disposition Project (IFDP) proposed to incorporate cleanup scope owned by NNSA, SC, and NE (223 additional facilities) into EM for completion.

The third initiative involves EM's receipt of $6 billion under the American Recovery and Reinvestment Act of 2009 (ARRA), of which $3.32 billion was allocated for D&D projects across the Complex. The D&D projects undertaken with the ARRA funds are those that can be completed by 2011 and provide a benefit of significant footprint reduction. Because of this additional funding, part of the EM baseline was accelerated, with selected projects being completed 2 to 13 years earlier than originally planned. The ARRA funding also provides for accelerated transfer of some of the excess facilities from SC, NE, and NNSA mentioned previously.

The Solution: D&D Program Map

To present key program information to multiple audiences, the D&D/FE developed the D&D Program Map, which provides graphical and tabular details on facility D&D projects and consolidates data from multiple locations into a single reference.

The D&D Program Map provides DOE management with a concise overview of the D&D Program, and serves as a communication tool to inform Congressional staff and stakeholders of the program and its status.

In addition to project-related information, The D&D Program Map contains basic information on D&D and a brief explanation of the DOE Complex-wide facility D&D work.

The 2008 ABB data serves as the foundation for the current version of the D&D Program Map, providing lifecycle costs, scope, and schedule for the most expensive D&D projects. Additional information regarding work-scope descriptions was extracted from IPABS and field reports from individual sites.

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This document presents an overview of DOE's Complex-wide facility D&D project locations, scope, and issues:

The D&D Program Map Report

In addition to project-related information, the D&D Program Map contains basic information on D&D ('D&D 101') and a brief explanation of the DOE Complex-wide facility D&D work, including

- Explanation of D&D and why it is important
- Identification of DOE facility types undergoing D&D and their end-state options
- Explanation of typical D&D project phases
- Discussion of major challenges and cost drivers to the D&D Program
- Explanation of how D&D is managed within EM
- Identification of waste types and their significance.

Updates are planned in the future to maintain accurate program status. For further information, please contact

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DOE Hosts Next-Generation Waste Glass Melter Workshop

Experts in nuclear waste vitrification from around the world assembled at the **Next-Generation Waste Glass Melter Technology Workshop** to produce a clear understanding of the current state of technology for waste glass melting throughout the world and a vision for next-generation technology development. The workshop in March of this year focused on assessing advanced melter technologies and developing a comprehensive research plan for melter design and demonstration. The host was DOE's Office of TID, which is evaluating alternative options for waste glass melting technologies for DOE's Office of EM. Delegates represented the USA, Germany, France, UK, China, India, Japan, South Korea, and Russia.

DOE's goal is to develop the next generation of waste glass melters to improve vitrification performance, and to enhance waste feed throughput and loading into the glass to significantly reduce lifecycle costs and mission durations. Technology development efforts are aimed at improving existing melters, such as Joule-heated, ceramic-lined, liquid-fed melters, as well as developing transformational melter technologies, such as induction and hybrid heated systems. The potential life-cycle cost savings is as much as $10 billion.

U.S. delegates focused their presentations on past, present, and future vitrification facilities. Discussions involved current operational problems in addition to improvements.

International delegates' presentations focused on current and future facilities based on either Joule-heated ceramic melters, hot-walled induction melters, or cold-crucible induction melters (CCIM).

A brainstorming session that followed the presentations generated technology development needs in melter feeding, materials of construction, diagnostics, glass composition, and other related subjects.

Mercury Treatment of Sump Water at Oak Ridge National Laboratory

A small, skid-based, ion-exchange treatment system has been successfully treating water from Sump I in Building 4501 at the Oak Ridge National Laboratory (ORNL) removing as much as 99% of the mercury. Sump water from Buildings 4501 and 4505 is transferred to the ORNL Process Water Treatment Complex (PWTC) prior to discharge to White Oak Creek. Before 2007, Sump I collected an average of 458 mg/day of mercury and was the largest point source of mercury to the PWTC, which discharged a total of 900 mg/day of mercury to White Oak Creek. Concentrations of mercury in the creek exceeded the Tennessee Water Quality Criteria.

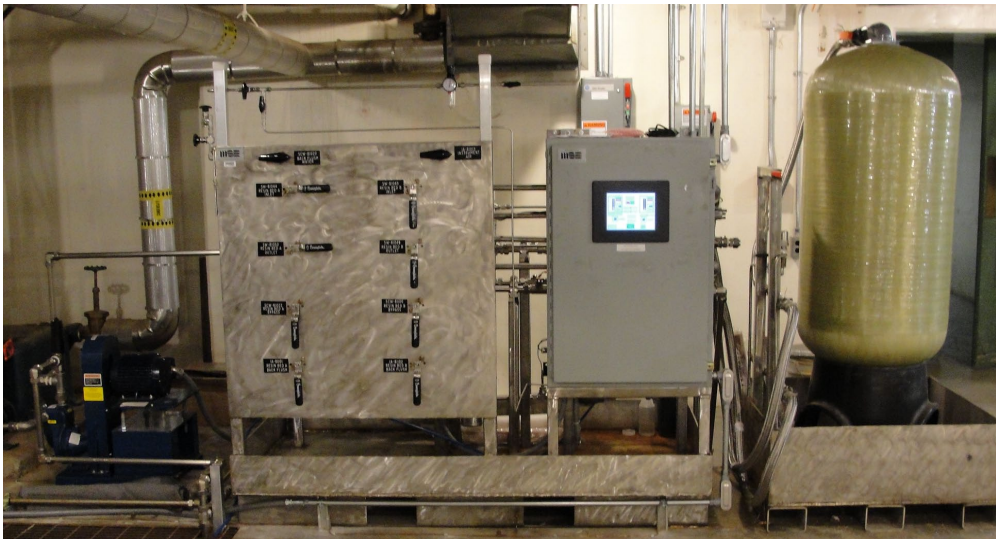
Between October 2009 and May 2010 2,940,000 gallons of water were treated and ~99% of the mercury was removed. Effluent from the PWTC contained 0.06 – 0.2 µg/L mercury before the treatment skid started operation, and only 0.008 – 0.03 µg/L mercury

More than 70 international delegates attended the Melter Workshop held in Washington DC in March 2010

afterward. Average mercury concentrations in White Oak Creek, downstream of the PWTC discharge, were reduced from 0.028 µg/L in 2007 to 0.008 µg/L in 2008 after system start up.

The Sump I treatment skid, designed and fabricated by MSE Technology Applications, Inc. (MSE), consists of a self-priming centrifugal pump, a flow control valve, an instrument and piping module, a programmable logic control panel, and a 52-inch tall ion-exchange column (as shown) containing a resin with a high affinity for mercury ions.

The project results will deliver important cost and performance data for the DOE Complex. . .



The mercury treatment skid at Sump I

During the first three months of operation, the effluent from the treatment system contained less than the detection limit of 0.05 µg/L mercury and has increased very slowly since then, because the resin absorbs mercury. The ion-exchange resin was replaced in May 2010. The spent resin will be disposed of as RCRA "high mercury" hazardous waste, which, based on earlier laboratory-scale tests, is expected to pass the EPA Toxicity Characteristics Leaching Procedure. Replacing the resin once a month will keep the mercury concentration below the "low mercury" limit of 260 mg/kg allowing the resin to be disposed of on-site as industrial waste. An economic analysis showed it would cost less to fully load the resin and dispose of it as hazardous waste.

The cost of the sump water treatment will be compared to the cost of treating the entire PWTC waste stream to evaluate which treatment approach has advantages. Preliminary data indicate that treatment of the individual source provides a significant advantage. The project results will deliver important cost and performance data for the DOE Complex, as decommissioning of facilities may require consideration of water management options that don't favor a traditional large water management facility. Source treatment of remaining sump collection areas as well as residual contamination may favor a mix of small, point-treatment facilities in combination with larger facilities. ORNL plans to use the data from this project to design the final configuration of its liquid treatment systems.

EM Conducts National Spent Nuclear Fuel Program Meeting

EM conducted a National Spent Nuclear Fuel Program (NSNFP) integration meeting March 24-25 in Idaho Falls, Idaho, providing an opportunity for the kind of collaboration among DOE offices, DOE site contractors, industry, international partners, and regulators that is essential for a fully integrated understanding of the issues affecting extended storage. About 75 people, including representatives from EM's major sites, the Defense Nuclear Facilities Safety Board, Nuclear Regulatory Commission, General Accounting Office, the newly formed Nuclear Energy Office of Used Fuel Disposition, and the Navy, attended. The program consisted of 20 presentations that ranged from budget planning to fuel degradation to adequacy of facilities for extended storage of spent nuclear fuel (SNF) and high-level waste (HLW). The presentations can be found at nsnfp.inel.gov/program/.

Yvette Collazo, EM's Director of TID, set the tone for the meeting by committing her investment in science and technology to focus on decreased life-cycle costs and reduction in the period of execution for EM's cleanup program. In line with the goals of the NSNFP, TID will partner with industry, DOE site offices and site contractors, and international experts to develop and share technologies to solve DOE's toughest challenges.

About 75 people attended the national SNF program meeting in Idaho Falls, ID.

Many attendees came to hear Dr. Steven Krahn, Deputy Assistant Secretary for EM's Safety and Security Program, discuss whether sites should continue to implement the Office of Civilian and Radioactive Waste Management (OCRWM) Quality Assurance Requirements Document (QARD). Even though the Yucca Mountain License

Application may be withdrawn, EM will continue to comply with the obligations in the Memorandum of Agreement between EM and OCRWM to manage SNF and HLW in accordance with the QARD. In the meantime, EM established a corporate board to integrate the OCRWM QA process into the overall EM corporate oversight and assessment activities.

Within the TID Program, Gary DeLeon, Director of the Office of Nuclear Materials Disposition, discussed EM's plans for interim management of SNF and challenging materials. Tony Kluk from Technical & Regulatory Support discussed EM's plans for interim management of HLW. Highlights from the presentations emphasized EM's plans to continue safe management and storage of SNF and HLW, honor all state commitments, and continue receipt of domestic and foreign research reactor fuel through 2019. EM plans to develop a technical basis for extended storage of SNF.

Dr. Patrick Schwab from NE's Office of Used Fuel Disposition described the NE mission to advance nuclear power as a resource to meet the nation's energy supply, environmental, and energy security needs through research, development, and demonstration. Dr. Schwab said NE plans to collaborate with EM and other organizations to enable sustainable fuel cycles, minimize proliferation, enable new plants, and extend the life of the existing fleet of nuclear reactors.

The NSNFP plans to host a follow-on meeting in Washington, DC, in the Fall of 2010, which will include topics to examine technologies for extended storage that are used by international partners.

EM Tank Waste Integrated Project Team

The EM Tank Waste Integrated Project Team (IPT) was formed in March 2009 to identify strategies to transform DOE EM's tank waste treatment project into a vastly more efficient, cost-effective, optimized system. DOE is currently storing almost 90 million gallons of high-level waste in underground tanks at the Hanford, Savannah River, and Idaho sites that must be retrieved, treated, and disposed to address the many challenges presented by such an undertaking. The IPT identified twelve technical strategies, six each at DOE's two largest waste sites, Hanford and Savannah River, with potential for optimizing existing or planned waste-processing operations or providing new system capabilities for EM's largest, highest risk, and most expensive project.

Having identified the technology development and/or regulatory actions needed to successfully implement the strategies, the IPT estimated implementation timeframes

Having identified the technology development and/or regulatory actions needed to successfully implement the strategies, the IPT estimated implementation timeframes for the strategies: three strategies could be implemented in the near-term (<5 years), while nine could be implemented in the mid-term (5-15 years), with one component of a mid-term strategy requiring long-term development (>15 years).

The IPT examined the cost implications of the strategies from two perspectives, one focusing on how the strategies would affect the cost performance baselines, and the other perspective focused on whether the expected benefits would likely justify the costs of development. Preliminary evaluation of cost implications demonstrated varying levels of cost benefits.

The IPT then evaluated the site strategies for the complex-wide tank waste system and ultimately made seven transformational technical recommendations that could significantly reduce overall life-cycle costs for DOE EM. Those recommendations have been or are being incorporated into site system plans. The Tank Waste IPT's transformational technical recommendations are:

TR-1 At-Tank/Near-Tank Processing – This strategy provides supplemental treatment capability at or near the waste storage tank. Modular equipment is used to enable removal of solids and radionuclides, speeding processing rates and allowing early operation of low-activity waste systems. This strategy will reduce overall time to treat wastes.

TR-2 Glass Optimization (including Next-generation Melters and Waste Loading Enhancements) – This strategy will improve waste loading and related processes and will develop next-generation melters. This strategy will reduce the number of glass canisters and overall processing time.

TR-3 Advanced Separation Processes – This strategy provides new processes to separate low-activity waste from tank waste to minimize the volume of high-activity waste. Implementing aluminum and caustic management to reduce the volume of high-activity waste to be treated is a key cost driver.

TR-4 Alternative Treatment/Disposal Processes – This strategy will develop alternative treatment processes, such as steam reforming and evaporation followed by sodium silicate solidification. The volume of waste that must be processed at existing waste treatment facilities will be reduced, cutting overall plant utilization and schedule.

TR-5 Waste Staging/Area Closure – This strategy will consolidate waste to improve feed to treatment facilities and allow whole tank farms to be closed.

TR-6 Mixing/Blending Systems Optimization – This strategy will provide optimized mixing and blending operations at Hanford to minimize glass waste volume by careful selection and mixing of compatible tank wastes.

TR-7 Integrated Systems Analysis – This strategy will continue work on development of tools to assist in performing integrated systems analysis. In particular, multiple attributes of the tank waste systems will be evaluated together to determine whether additional transformational changes can be made.

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